

5

surface area, as well as a limited depth. This combination may help to reduce a volume of a device consumed by this contact structure.

FIG. 4 illustrates a side view of a contact structure according to an embodiment of the present invention. Contacts 112 may include notches 302. Similarly, frame 210 may include notches 212. Pliable membranes 220 may be formed using insert molding or similar technique to fill notches 302 and 212 with tabs 222 and 224. As before, contact 112 may be electrically connected to traces on board 250 using compliant conductive paths 240.

In various embodiments of the present invention, other interlocking features may be used to secure contacts 112 in place in frame 210. An example is shown in the following figure.

FIG. 5 illustrates a side view of a contact structure according to an embodiment of the present invention. In this example, contacts 112 may have a wide upper portion 512 and a narrower lower portion 514. Pliable membrane 220 may include a narrow upper portion 522 and a wider lower portion 524. In this way, as a downward force is applied to contact 112, contact 112 is held in place relative to pliable membrane 220.

Frame 210 of the contact structures in these in other embodiments of the present invention may be formed as part of a device enclosure housing an electronic device. In other embodiments the present invention, the device enclosure may have an opening and frame 210 of the contact structure may be placed in that opening. Frame 210 may be secured in the opening in the device housing in various ways. Examples are shown in the following figure.

FIG. 6 illustrates a side view of a contact structure in a portion of a device housing according to an embodiment of the present invention. In this example, contact 112 may be secured to frame 210 by pliable membrane 220. Frame 210 may be secured to housing 610 by membrane 620. Membrane 620 may be rigid or pliable. Membrane 620 may be formed by insert molding or other techniques. Membrane 620, as with membrane 220, may help to prevent the ingress of moisture, debris, or other matter into an electronic device housing this contact structure.

As with contacts 112 in frame 210, interlocking features may be used to secure frame 210 to device housing 610. This may prevent frame 210 from being pushed into the electronic device when contact is made with a second electronic device. An example is shown in the following figure.

FIG. 7 illustrates a side view of a contact structure and a portion of a device housing according to an embodiment of the present invention. In this example, frame 210 may include notch 218 in an outside wall. Similarly, device housing 610 may include notch 612 in an inside wall of an opening. Tabs 622 and 624 of membrane 620 may be located in notches 612 and 218. These interlocking features may help to secure frame 210 to device housing 610. As before, contacts 112 may be electrically connected to traces on board 250 through compliant conductive paths 240.

Again, in the above examples, membranes 620 and 220 may be used to provide protection from moisture and particulate or debris ingress into an electronic device. In other embodiments of the present invention, other structures may be used to prevent such ingress. An example is shown in the following figure.

FIG. 8 illustrates a side view of a contact structure in a portion of a device housing according to an embodiment of the present invention. In this example, frame 210 and device housing 610 may have a gasket or O-ring 810 placed between them. This gasket or O-ring 810 may be secured in

6

place using a glue, silicone, or other adhesive. Gasket or O-ring 810 may provide protection against moisture or debris ingress into an electronic device incorporating this contact structure. As before, contacts 112 may be secured to frame 210 using pliable membranes 220. Contacts 112 may be electrically connected to traces on board 250 using compliant conductive paths 240.

Embodiments of the present invention may provide contact structures that may be located in various types of devices, such as portable computing devices, tablet computers, desktop computers, laptops, all-in-one computers, wearable computing devices, cell phones, smart phones, media phones, storage devices, portable media players, navigation systems, monitors, power supplies, adapters, remote control devices, chargers, and other devices. These devices may include contact structures that may provide pathways for signals and power compliant with various standards such as one of the Universal Serial Bus (USB) standards including USB Type-C, HDMI, DVI, Ethernet, DisplayPort, Thunderbolt, Lightning, JTAG, TAP, DART, UARTs, clock signals, power signals, and other types of standard, non-standard, and proprietary interfaces and combinations thereof that have been developed, are being developed, or will be developed in the future. In one example, the contact structures may be used to convey a data signal, a power supply, and ground.

The above description of embodiments of the invention has been presented for the purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form described, and many modifications and variations are possible in light of the teaching above. The embodiments were chosen and described in order to best explain the principles of the invention and its practical applications to thereby enable others skilled in the art to best utilize the invention in various embodiments and with various modifications as are suited to the particular use contemplated. Thus, it will be appreciated that the invention is intended to cover all modifications and equivalents within the scope of the following claims.

What is claimed is:

1. A contact structure comprising:

- a frame having a plurality of passages from a top of the frame to a bottom of the frame, each passage having an inside edge, wherein the frame is nonconductive;
- a plurality of contacts, each contact having a top surface, a bottom surface, and an outside edge and located in one of the plurality of passages; and
- a plurality of pliant membranes, each between the outside edge of one of the plurality of contacts and the inside edge of a passage such that at least a portion of a top surface and at least a portion of a bottom surface of the contact are exposed.

2. The contact structure of claim 1 wherein a top surface of each of the plurality of contacts is circular.

3. The contact structure of claim 1 wherein the outside edge of each of the plurality of contacts and an adjacent inside edge of each of the plurality of pliant membranes each comprise first interlocking features that interlock to secure the plurality of contacts in place in the plurality of pliant membranes.

4. The contact structure of claim 3 wherein an outside edge of each of the plurality of pliant membranes and the inside edge of each of the plurality of passages each comprise second interlocking features.

5. The contact structure of claim 4 wherein the first interlocking features include a first notch located circumferentially around the outside edge of each of the plurality of